



## Temperature Profiles and Column Damping

In the ProTips™ Volume 2, Issue 3, March 2018 edition we elaborated on column damping and how to use it. In this edition, we throw additional light on error messages related to damping, and some intuitive methods to pre-empt the need for damping in some columns.

### Damping Error Messages in ProTreat®

When ProTreat® solves each tray or segment of packing, it is solving several dozen highly non-linear algebraic equations, as a high-fidelity simulator. In solving these equations, from their initial states, sometimes there might be potential discontinuities, and ill-behaved equations that can destabilize numerical methods used. ProTreat® normally identifies such situations during run-time and provides user guidance through error messages as shown below in Figure 1.

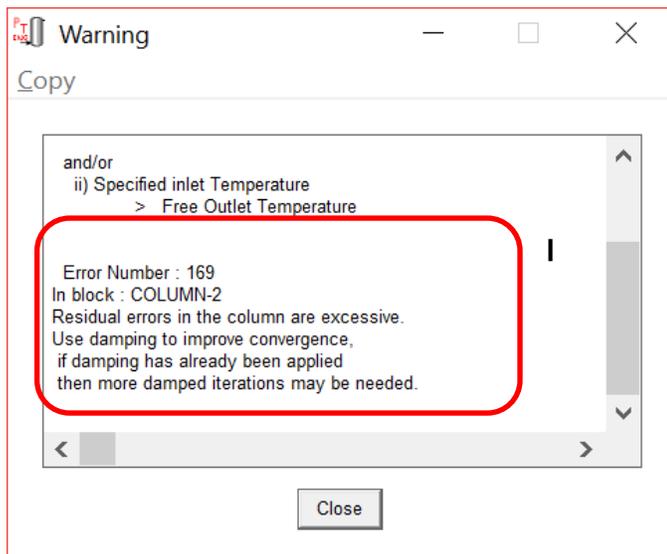


Figure 1. Column Damping Error

Whenever such an error (as shown in Figure 1) is reported by ProTreat® you may add damping to the specific column in question, in this case this is “Column-2”. However, at times, a user may be able to pre-empt the need for damping by observing the column temperature profiles during run time. See Figure 2, for an example. In Figure 2, the temperature profile shows some erratic behaviour at the top of the trayed column. In most cases, ProTreat® will normally move past this erratic behaviour and successfully solve the equations, as it operates based on first principles and well-tested and established numerical methods. Sometimes the erratic behaviour, might also be a

result of the initial estimates provided in the recycle blocks. Adding some mild damping in such cases may assist in stabilizing the calculations, especially when dealing with batch-runs of multiple files, or unsupervised simulation runs during off-hours.

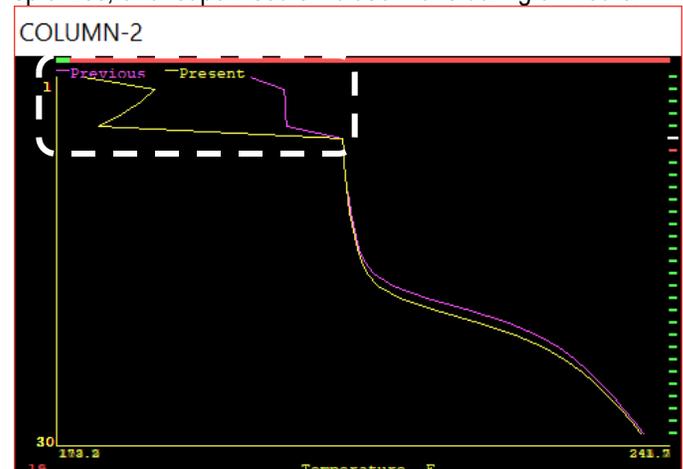


Figure 2. Erratic Temperature Profiles

As was pointed out in the March 2018 edition of ProTips™, it is important to understand and remember that damping has no physical significance in general. At best it might indicate that the column might be at a stability limit, and each case should be treated on its own merits rather than over-generalizations. Similarly, when one observes erratic temperature profiles, there might be systematic, input, or physically significant errors, that might need investigation. However, and again, no generalizations may be made that erratic temperature profiles (that may eventually ease out and produce sensible and valid results) have underlying physical phenomenon.

**PROTIP:** While it may be tempting to add damping to all the columns that are setup in ProTreat®, this should never be resorted to. Damping should be the exception, and never the norm. One should use damping only if prompted by ProTreat® or when one observes erratic behavior in the column convergence graphic. The additional information provided in this edition of ProTips is to illustrate and clarify the meaning of damping, and applicability.

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